

# **Stream Habitat and Water-Quality Information for Sites in the Buffalo River Basin and Nearby Basins of Arkansas, 2001-2002**

Prepared in cooperation with the  
NATIONAL PARK SERVICE and the  
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE

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Gale A. Norton, Secretary

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# Stream Habitat and Water-Quality Information for Sites in the Buffalo River Basin and Nearby Basins of Arkansas, 2001-2002

By James C. Petersen

## Abstract

The Buffalo River lies in north-central Arkansas and is a tributary of the White River. Stream-habitat and water-quality information are presented for 52 sites in the Buffalo River Basin and adjacent areas of the White River Basin. The information was collected during the summers of 2001 and 2002 to supplement fish community sampling during the same time period.

## Introduction

The Buffalo River lies in north-central Arkansas and is a tributary of the White River (fig. 1). It has a length of approximately 240 km (National Park Service, 2003) and at its mouth has a drainage area of 3,470 km<sup>2</sup> (Sullivan, 1974). Most of the length of the Buffalo River lies within the boundaries of Buffalo National River, a unit of the National Park Service; the upper 24 river km lie within the boundary of the Ozark National Forest (National Park Service, 2003). Much (about 27 percent of the Buffalo River Basin) of the upper and extreme lower parts of the Buffalo River Basin on the south side of the Buffalo River is within the Ozark National Forest.

## Purpose and Scope

The purpose of this report is to summarize selected environmental factors (stream-habitat and water-quality information) (2001-2002) for 52 sites in the Buffalo River Basin and nearby basins of the White River Basin in Arkansas (table 1). The information was collected to supplement fish community sampling at the same 52 sites during 2001-2002 (Petersen, 2004). Environmental factors summarized include measures of stream size, channel morphometry, riparian cover, and water quality. Additional measurements of basin characteristics and habitat conditions are available (Panfil and Jacobson, 2001; Jacobson and others, 2004); the reach scale measurements were made during the summer of 1999 (Panfil and Jacobson, 2001) and the summers of 2001 and 2002 (Jacobson and others, 2004).

## Acknowledgments

This investigation was conducted in cooperation with the National Park Service and the U.S. Department of Agriculture Forest Service. Analysis of water-quality samples was provided by the Arkansas Department of Environmental Quality. Dan Magoulick (U.S. Geological Survey and Arkansas Cooperative Fish and Wildlife Research Unit) and Shawn Hodges (Arkansas Cooperative Fish and Wildlife Research Unit) provided substantial input regarding site selection during 2001. Several Forest Service employees assisted with sampling of several sites in 2001 and 2002. Several National Park Service employees provided logistical support and assisted with sampling in one or both years; David Mott, Faron Usrey, Jessica Luraas, and John Petty were particularly helpful. The National Park Service also provided lodging for sampling crews. A number of landowners provided access to sampling sites. Ty Blacklock assisted by volunteering as a crew member on several days in 2001. The cooperation of each of these agencies and individuals is gratefully appreciated.

## Description of Study Area

The study area includes the Buffalo River Basin and selected smaller basins adjacent to the Buffalo River Basin within the White River Basin in north-central Arkansas (fig. 1). At its mouth, the Buffalo River has a drainage area of approximately 3,470 km<sup>2</sup> (Sullivan, 1974). All of the basins lie within the Ozark Plateaus.

## Stream Habitat Characteristic Measurement and Data Processing Methods

Stream habitat data (some summarized in Petersen, 2004) generally were collected on the day that the fish communities were sampled in 2001 and 2002. The generalized curvilinear length of each geomorphic unit (riffle, pool, glide) in a sampling reach was measured using either a laser rangefinder or mea-

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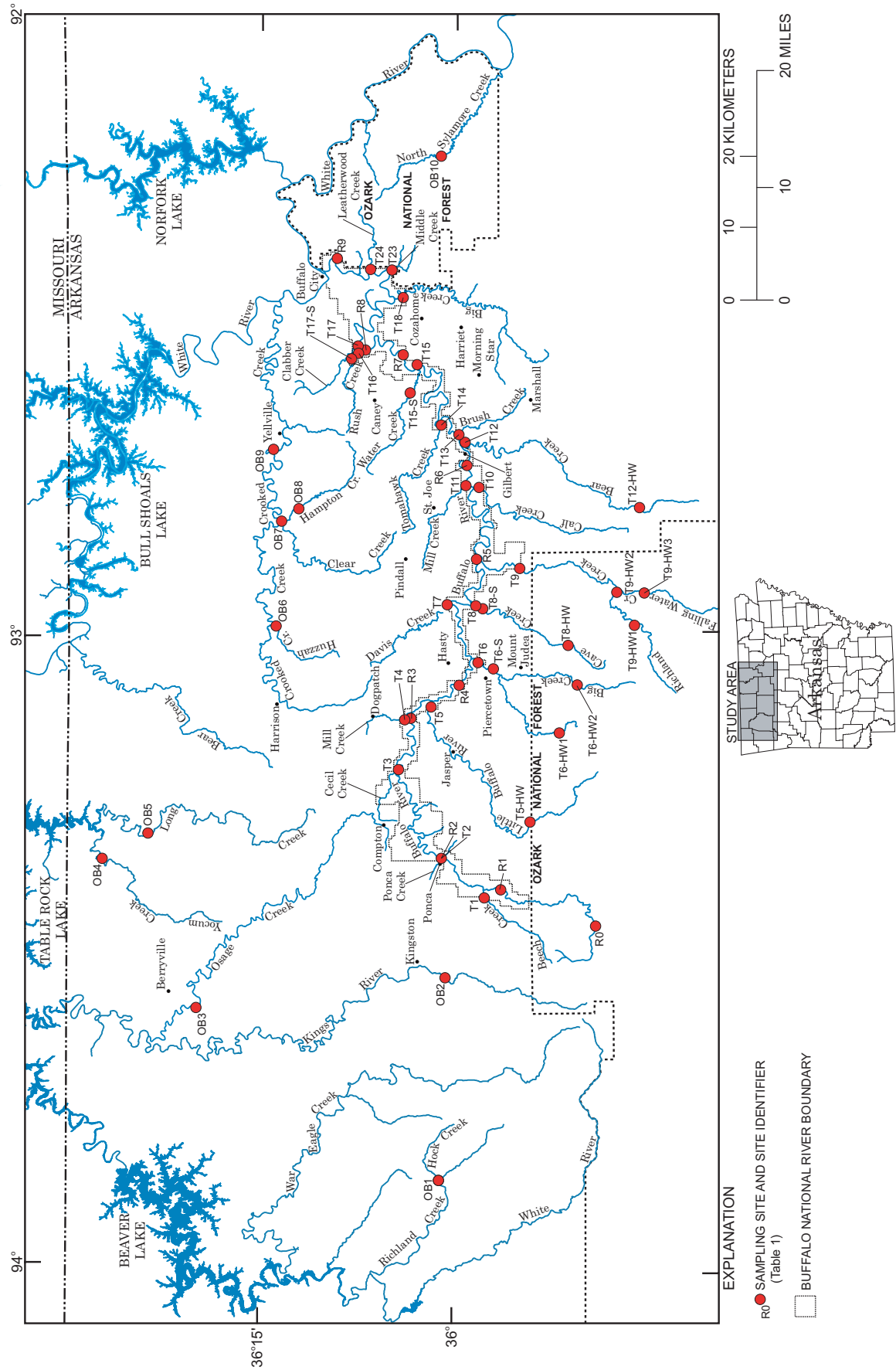


Figure 1. Location of sampling sites.

suring tape. The rangefinder was used for lengths greater than about 5 meters. At each reach, stream morphometry, an index of water velocity, and measures of riparian cover were measured at several transects. Transects were placed through riffles, pools, and glides within each reach. At least one transect was placed through each riffle, pool, and glide within a reach. Spacing was such that transects within a given geomorphic unit were placed through typical portions of the unit. Single transects were placed through a geomorphic unit if the unit length was less than about 30 m. An additional transect was placed through each unit for each additional 25 to 35 meters of length; for example, an 80-meter pool typically would have three transects spaced approximately 20 to 30 meters apart. Where lengths of geomorphic units exceeded about 100 meters the distance between transects was increased to about 50 to 100 meters.

Wetted stream width was measured at each transect. Widths of less than about 5 meters were measured using a measuring tape stretched across the transect. Greater widths were measured using a laser rangefinder.

Water depth and an index of water velocity were recorded at three locations across the transect. These locations included the thalweg and two other locations selected so that the three locations were approximately one-quarter, one-half, and three-quarters of the distance across the transect and representative of that portion of the transect. Water depth was measured using a meter stick inserted so that the narrow edge of the stick was oriented parallel to the water flow. An index of velocity was measured by orienting the meter stick so that the narrow edge of the stick was perpendicular to the water flow and measuring the distance between the elevation of water piled up on the upstream side of the stick and the elevation of the water on the downstream side of the stick (Angermeier and Schlosser, 1989).

Wolman pebble counts (Wolman, 1954) were performed in the reach to estimate particle size. Fifty particles were measured in each of two riffles, pools, and glides (300 particles per reach). For the 300 reach particles, D16 (16th percentile), D50 (50th percentile), and D84 (84th percentile) values were calculated. When bedrock was encountered the occurrence was noted and was counted as one of the 300 values. However, the bedrock was not included in the calculation of the percentile values. Percent bedrock was calculated from the 300 particle data set by dividing the number of bedrock occurrences by 300.

Shading was measured using two approaches (Platts and others, 1983; Platts and others, 1987; Fitzpatrick and others, 1998). The open canopy angle was measured from the midpoint of each transect using a clinometer to measure the angles between the stream surface and the top of representative vegetation or other features (bluffs or stream bank) at each end of each transect. The sum of these two angles then was subtracted from 180 degrees to calculate the open canopy angle. Canopy closure along each bank was measured using a convex spherical densiometer modified so that 17 grid intersections were visible; the number of grid intersections covered by the image of overhead vegetation was counted for canopy closure (Fitzpatrick and others, 1998).

Summary values of transect-related habitat data collected were calculated to describe the sampling reach. For most habitat measures (wetted width, depth, velocity, open canopy angle, and canopy closure), a length-weighted mean value was calculated using an equation similar to the following equation for mean width:

$$WMW = [(Length_{pool} \times MW_{pool}) + (Length_{run} \times MW_{glide}) + (Length_{riffle} \times MW_{riffle})] / Length_{reach}$$

where  $WMW$  is length-weighted mean width,

$Length_{pool}$  is total length of all pools in reach,

$MW_{pool}$  is mean width of all transects in pools,

$Length_{run}$  is total length of all runs in reach,

$MW_{glide}$  is mean width of all transects in glides,

$Length_{riffle}$  is total length of all riffles in reach,

$MW_{riffle}$  is mean width of all transects in riffles, and

$Length_{reach}$  is total length of reach.

## Water-Quality Sampling Methods

At most sites water samples were collected by the National Park Service (samples were collected at a few sites by the Arkansas Department of Environmental Quality or the Geological Survey). Approximately four times per year grab samples were collected from the centroid of streamflow beginning in April 2001 and continuing through October 2002. Dissolved oxygen, pH, water temperature, and specific conductance were measured in the field. Samples were transported on ice to laboratories of the Arkansas Department of Environmental Quality for analysis (samples collected by the Geological Survey from Yocum Creek were shipped overnight to a Geological Survey laboratory in Lakewood, Colorado).

## Stream-Habitat and Water-Quality Information

Stream-habitat information for each of the sites is summarized in table 2. Values are presented for measurements made in the summers of 2001 and 2002. Water-quality information is summarized in table 3. Mean values are presented for each of 48 sites. Water-quality data were not collected at four sites (sites T6-S, T8-S, T15-S, and T17-S) because of their proximity to other sites.

## Summary

The Buffalo River lies in north-central Arkansas and is a tributary of the White River. Stream-habitat and water-quality information (environmental factors) are presented for 52 sites in



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the Buffalo River Basin and adjacent areas of the White River Basin. The information was collected during the summers of 2001 and 2002 to supplement fish community sampling during the same time period. The environmental factors summarized include measures of stream size, channel morphometry, riparian cover, and water quality.

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**Table 1.** Sampling site locations.

Site identifier (see fig. 1)	Site name	County	Township, range, section
R0	Buffalo River at Dixon Ford near Fallsville	Newton	T.13 N., R.23 W., sec. 5
R1	Buffalo River near Boxley	Newton	T.15 N., R.23 W., sec. 22
R2	Buffalo River near Ponca	Newton	T.16 N., R.22 W., sec. 30
R3	Buffalo River near Pruitt	Newton	T.16 N., R.20 W., sec. 7
R4	Buffalo River near Hasty	Newton	T.16 N., R.20 W., sec. 34
R5	Buffalo River near Woolum	Searcy	T.15 N., R.18 W., sec. 4
R6	Buffalo River at Shine Eye near Gilbert	Searcy	T.16 N., R.17 W., sec. 36
R7	Buffalo River at Highway 14 near Harriet	Marion	T.17 N., R.15 W., sec. 34
R8	Buffalo River near Rush	Marion	T.17 N., R.5 W., sec. 14
R9	Buffalo River near mouth near Buffalo City	Marion	T.18 N., R.14 W., sec. 36
T1	Beech Creek near mouth near Boxley	Newton	T.15 N., R.23 W., sec. 16
T2	Ponca Creek near mouth near Ponca	Newton	T.16 N., R.22 W., sec. 30
T3	Cecil Creek near mouth near Erbie	Newton	T.17 N., R.21 W., sec. 33
T4	Mill Creek near mouth near Pruitt	Newton	T.16 N., R.20 W., sec. 6
T5	Little Buffalo River near mouth near Pruitt	Newton	T.16 N., R.20 W., sec. 20
T5-HW	East Fork Little Buffalo River near Murray	Newton	T.15 N., R.22 W., sec. 34
T6	Big Creek near mouth near Carver	Newton	T.15 N., R.19 W., sec. 6
T6-S	Big Creek near Vendor	Newton	T.15 N., R.20 W., sec. 13
T6-HW1	Left Fork Big Creek near Red Rock	Newton	T.14 N., R.21 W., sec. 12
T6-HW2	Big Creek near Mt. Judea	Newton	T.14 N., R.20 W., sec. 23
T7	Davis Creek near mouth near Mt. Hersey	Newton	T.16 N., R.19 W., sec. 26
T8	Cave Creek near mouth near Mt. Hersey	Newton	T.15 N., R.19 W., sec. 1
T8-S	Cave Creek near Woolum	Newton	T.16 N., R.19 W., sec. 11
T8-HW	Cave Creek near Bass	Newton	T.15 N., R.19 W., sec. 1
T9	Richland Creek near mouth near Eula	Searcy	T.15 N., R.18 W., sec. 22
T9-HW1	Richland Creek near Ben Hur	Newton	T.13 N., R.19 W., sec. 14
T9-HW2	Richland Creek near Witts Springs	Searcy	T.13 N., R.18 W., sec. 6
T9-HW3	Falling Water Creek near Witts Springs	Searcy	T.13 N., R.18 W., sec. 19
T10	Calf Creek near mouth near Silver Hill	Searcy	T.15 N., R.17 W., sec. 3
T11	Mill Creek near mouth near Silver Hill	Searcy	T.16 N., R.17 W., sec. 34
T12	Bear Creek near mouth near Gilbert	Searcy	T.16 N., R.16 W., sec. 32
T12-HW	Bear Creek near Welcome Home	Searcy	T.13 N., R.17 W., sec. 16
T13	Brush Creek near mouth near Gilbert	Searcy	T.16 N., R.16 W., sec. 28
T14	Tomahawk Creek near mouth near Tomahawk	Searcy	T.16 N., R.16 W., sec. 20/21
T15	Water Creek near mouth near Evening Star	Searcy	T.16 N., R.15 W., sec. 9
T15-S	Water Creek near Maumee	Searcy	T.16 N., R.16 W., sec. 1
T16	Rush Creek near mouth near Rush	Marion	T.17 N., R.15 W., sec. 10
T17	Clabber Creek near mouth near Rush	Marion	T.17 N., R.15 W., sec. 11
T17-S	Clabber Creek near Rush	Marion	T.17 N., R.15 W., sec. 3
T18	Big Creek near mouth near Cozahome	Marion	T.17 N., R.14 W., sec. 33
T23	Middle Creek near mouth near Big Flat	Marion	T.17 N., R.14 W., sec. 29
T24	Leatherwood Creek near mouth near Advance	Marion	T.17 N., R.14 W., sec. 13
OB1	Hock Creek near Wesley	Madison	T.16 N., R.27 W., sec. 28
OB2	Kings River near Kingston	Madison	T.16 N., R.24 W., sec. 29
OB3	Osage Creek near Berryville	Carroll	T.19 N., R.25 W., sec. 12
OB4	Yocum Creek near Oak Grove	Carroll	T.21 N., R.22 W., sec. 30
OB5	Long Creek near Denver	Carroll	T.20 N., R.22 W., sec. 16
OB6	Huzzah Creek near Olvey	Boone	T.18 N., R.19 W., sec. 10
OB7	Clear Creek near Pyatt	Marion	T.18 N., R.17 W., sec. 7
OB8	Hampton Creek near Eros	Marion	T.18 N., R.17 W., sec. 21
OB9	Crooked Creek near Summit	Marion	T.18 N., R.16 W., sec. 6
OB10	North Sylamore Creek near Big Flat	Stone	T.16 N., R.12 W., sec. 15

**Table 2. Stream-habitat information.**

[Values for canopy angle, canopy cover, depth, velocity index, and width are length-weighted means based on riffle, glide, and pool lengths and mean values for riffles, glides, and pools. km<sup>2</sup>, square kilometers; cm, centimeters; mm, millimeters; m, meters; D16, D50, and D84, 16th, 50th, and 84th percentiles of substrate particle sizes from Wolman pebble counts]

Site name	Site identifier	Date	Drainage area (km <sup>2</sup> )	Canopy angle (degrees)	Canopy cover (number of grid inter-sections covered)	Depth (cm)	Wetted width (m)	Velocity index (mm)	D16 (mm)	D50 (mm)	D84 (mm)	Bedrock (percent)
Buffalo River at Dixon Ford near Fallsville	R0	06/25/01	51	83	8.8	27.3	9.5	1.4	20	33	101	8.7
Buffalo River at Dixon Ford near Fallsville	R0	06/20/02	51	89	6.5	39.4	9.2	10.3	10	60	170	30.0
Buffalo River near Boxley	R1	07/31/01	150	73	13.0	63.3	21.4	1.5	5	55	178	7.3
Buffalo River near Boxley	R1	08/07/02	150	79	7.6	51.2	19.3	1.4	5	30	100	14.7
Buffalo River near Ponca	R2	07/30/01	297	67	12.9	38.1	22.4	4.7	35	75	120	0.0
Buffalo River near Ponca	R2	07/23/02	297	67	13.3	35.6	19.3	5.2	15	55	170	4.7
Buffalo River near Pruitt	R3	08/03/01	494	56	15.4	46.0	22.4	8.7	30	55	90	18.0
Buffalo River near Pruitt	R3	06/27/02	494	73	9.9	89.3	22.7	13.6	15	50	100	10.7
Buffalo River near Hasty	R4	07/31/01	984	116	6.6	73.3	26.0	6.1	20	50	105	0.0
Buffalo River near Hasty	R4	07/15/02	984	104	8.7	103.7	32.8	2.2	10	50	115	5.0
Buffalo River near Woolum	R5	07/18/01	1,553	118	7.2	149.2	30.4	2.8	20	55	147	17.0
Buffalo River near Woolum	R5	07/16/02	1,553	116	7.0	158.4	30.9	5.0	25	55	100	5.0
Buffalo River at Shine Eye near Gilbert	R6	07/18/01	2,150	109	7.0	86.2	32.2	3.4	20	45	110	12.3
Buffalo River at Shine Eye near Gilbert	R6	07/17/02	2,150	105	4.2	131.0	40.5	8.9	5	43	110	2.7
Buffalo River at Highway 14 near Harriet	R7	07/20/01	2,778	111	8.3	56.6	34.4	5.8	30	55	138	5.0
Buffalo River at Highway 14 near Harriet	R7	09/13/02	2,778	132	5.6	69.8	31.0	8.7	20	30	60	10.8
Buffalo River near Rush	R8	07/26/01	2,840	110	7.7	86.1	49.5	1.6	10	25	40	0.0
Buffalo River near Rush	R8	07/18/02	2,840	111	7.0	97.9	56.0	9.2	4	30	70	2.3
Buffalo River near mouth near Buffalo City	R9	07/24/01	3,455	111	4.6	78.5	51.3	2.7	15	45	170	54.3
Buffalo River near mouth near Buffalo City	R9	07/12/02	3,455	NA	NA	NA	NA	NA	30	65	276	47.5
Beech Creek near mouth near Boxley	T1	06/19/01	49	57	11.8	23.7	9.5	3.7	NA	NA	NA	NA
Beech Creek near mouth near Boxley	T1	06/20/02	49	62	13.1	28.7	11.5	6.2	4	35	278	24.3
Ponca Creek near mouth near Ponca	T2	07/31/01	12	18	16.0	17.5	4.5	0.9	NA	NA	NA	NA
Ponca Creek near mouth near Ponca	T2	06/25/02	12	11	15.5	17.2	4.3	5.3	15	60	170	5.7
Cecil Creek near mouth near Erbie	T3	06/20/01	57	47	12.1	57.0	8.4	0.8	30	105	212	0.0

**Table 2.** Stream-habitat information.—Continued

[Values for canopy angle, canopy cover, depth, velocity index, and width are length-weighted means based on riffle, glide, and pool lengths and mean values for riffles, glides, and pools. km<sup>2</sup>, square kilometers; cm, centimeters; mm, millimeters; m, meters; D16, D50, and D84, 16th, 50th, and 84th percentiles of substrate particle sizes from Wolman pebble counts]

Site name	Site identifier	Date	Drainage area (km <sup>2</sup> )	Canopy angle (degrees)	Canopy cover (number of grid inter-sections covered)	Depth (cm)	Wetted width (m)	Velocity index (mm)	D16 (mm)	D50 (mm)	D84 (mm)	Bedrock (percent)
Cecil Creek near mouth near Erbie	T3	06/24/02	57	66	11.3	51.6	8.2	2.3	1	70	300	9.0
Mill Creek near mouth near Pruitt	T4	08/01/01	54	72	12.3	62.3	15.9	0.4	10	50	120	9.3
Mill Creek near mouth near Pruitt	T4	06/21/02	54	48	10.3	47.2	13.2	3.1	1	20	50	9.7
Little Buffalo River near mouth near Pruitt	T5	08/02/01	369	76	9.8	76.4	15.8	4.4	35	75	120	5.7
Little Buffalo River near mouth near Pruitt	T5	08/19/02	369	92	9.3	42.4	21.7	2.7	20	50	100	6.0
East Fork Little Buffalo River near Murray	T5-HW	06/23/01	58	53	16.1	28.2	7.2	3.7	20	80	251	2.0
East Fork Little Buffalo River near Murray	T5-HW	06/19/02	58	51	11.1	35.6	8.6	12.3	15	65	300	3.7
Big Creek near mouth near Carver	T6	08/07/01	230	82	9.8	51.9	18.6	2.3	40	70	105	3.3
Big Creek near mouth near Carver	T6	07/24/02	230	89	10.0	61.4	24.2	3.7	15	40	110	0.0
Big Creek near Vendor	T6-S	08/08/01	219	110	4.6	36.7	13.1	0.8	25	60	110	0.0
Big Creek near Vendor	T6-S	07/23/02	219	116	4.5	48.6	12.9	3.4	15	50	100	0.0
Left Fork Big Creek near Red Rock	T6-HW1	06/25/01	25	39	12.5	14.5	4.5	0.8	10	20	40	5.3
Left Fork Big Creek near Red Rock	T6-HW1	06/19/02	25	45	10.7	28.7	6.9	4.1	10	55	250	28.7
Big Creek near Mt. Judea	T6-HW2	07/26/01	53	74	10.5	26.4	8.1	2.7	5	65	250	0.0
Big Creek near Mt. Judea	T6-HW2	06/25/02	53	67	8.3	25.8	9.3	2.8	5	30	231	4.0
Davis Creek near mouth near Mt. Hersey	T7	08/03/01	72	57	13.9	21.0	9.2	1.7	25	50	110	0.0
Davis Creek near mouth near Mt. Hersey	T7	07/22/02	72	41	10.3	23.3	6.7	1.9	10	35	70	11.0
Cave Creek near mouth near Mt. Hersey	T8	08/08/01	134	67	9.8	49.0	15.0	1.7	17	61	142	23.0
Cave Creek near mouth near Mt. Hersey	T8	07/26/02	134	66	11.7	47.1	16.3	4.0	10	60	130	16.7
Cave Creek near Woolum	T8-S	08/01/01	130	74	8.7	40.2	13.3	3.7	5	30	117	29.7
Cave Creek near Woolum	T8-S	07/24/02	130	77	7.5	32.7	12.3	6.0	10	29	70	25.3
Cave Creek near Bass	T8-HW	07/25/01	34	NA	10.1	20.5	3.9	0.5	NA	NA	NA	NA
Cave Creek near Bass	T8-HW	08/01/02	34	37	NA	18.9	7.7	2.1	NA	NA	NA	NA
Richland Creek near mouth near Eula	T9	07/13/01	313	87	7.0	46.9	17.2	0.1	5	45	150	0.0
Richland Creek near Ben Hur	T9-HW1	08/06/01	67	33	13.1	40.1	8.3	1.2	33	90	190	0.0
Richland Creek near Ben Hur	T9-HW1	07/25/02	67	54	13.7	53.4	10.3	10.4	10	40	180	10.3

**Table 2. Stream-habitat information.—Continued**

[Values for canopy angle, canopy cover, depth, velocity index, and width are length-weighted means based on riffle, glide, and pool lengths and mean values for riffles, glides, and pools. km<sup>2</sup>, square kilometers; cm, centimeters; mm, millimeters; m, meters; D16, D50, and D84, 16th, 50th, and 84th percentiles of substrate particle sizes from Wolman pebble counts]

Site name	Site identifier	Date	Drainage area (km <sup>2</sup> )	Canopy angle (degrees)	Canopy cover (number of grid inter-sections covered)	Depth (cm)	Wetted width (m)	Velocity index (mm)	D16 (mm)	D50 (mm)	D84 (mm)	Bedrock (percent)
Richland Creek near Wits Springs	T9-HW2	06/28/01	113	62	13.5	50.2	13.1	1.9	10	40	160	32.0
Richland Creek near Wits Springs	T9-HW2	08/21/02	113	69	10.6	79.4	17.1	7.0	8	80	529	42.3
Falling Water Creek near Wits Springs	T9-HW3	06/29/01	49	45	12.6	38.9	6.1	0.8	30	90	220	0.0
Falling Water Creek near Wits Springs	T9-HW3	07/25/02	49	52	11.6	60.3	9.9	9.0	10	40	100	33.7
Calf Creek near mouth near Silver Hill	T10	06/21/01	124	88	7.0	24.8	9.4	3.1	30	50	100	0.0
Calf Creek near mouth near Silver Hill	T10	07/22/02	124	94	5.5	34.3	14.3	5.9	1	20	50	0.0
Mill Creek near mouth near Silver Hill	T11	06/22/01	36	34	14.1	25.5	6.9	1.6	10	40	90	0.0
Mill Creek near mouth near Silver Hill	T11	06/29/02	36	22	14.5	22.0	7.3	11.3	10	34	90	0.0
Bear Creek near mouth near Gilbert	T12	07/12/01	238	40	9.2	32.4	11.5	2.5	20	45	120	11.7
Bear Creek near mouth near Gilbert	T12	08/08/02	238	41	NA	41.9	10.9	3.9	NA	NA	NA	NA
Bear Creek near Welcome Home	T12-HW	06/27/01	37	58	11.7	13.3	3.9	3.2	NA	NA	NA	NA
Bear Creek near Welcome Home	T12-HW	07/30/02	37	34	NA	19.1	5.6	4.2	NA	NA	NA	NA
Brush Creek near mouth near Gilbert	T13	07/16/01	50	16	10.1	13.2	3.9	1.3	25	50	90	0.0
Brush Creek near mouth near Gilbert	T13	06/28/02	50	15	15.6	23.0	6.0	6.2	10	30	80	1.3
Tomahawk Creek near mouth near Tomahawk	T14	08/10/01	95	38	13.4	22.7	9.3	6.4	35	60	90	0.0
Tomahawk Creek near mouth near Tomahawk	T14	07/19/02	95	37	14.3	25.6	13.4	7.9	10	40	90	1.0
Water Creek near mouth near Evening Star	T15	08/21/01	99	53	9.9	22.6	9.0	3.5	20	45	176	23.0
Water Creek near mouth near Evening Star	T15	07/08/02	99	69	11.3	22.8	12.3	5.0	2	15	40	19.7
Water Creek near Maumee	T15-S	08/09/01	89	51	13.3	28.7	6.3	3.8	15	37	80	0.0
Water Creek near Maumee	T15-S	08/22/02	89	58	9.8	22.4	6.7	4.1	10	40	70	5.3
Rush Creek near mouth near Rush	T16	07/25/01	36	32	10.6	13.4	7.3	2.0	30	78	156	0.0
Rush Creek near mouth near Rush	T16	08/23/02	36	50	12.0	15.8	6.1	2.1	10	40	140	0.0
Clabber Creek near mouth near Rush	T17	07/27/01	67	68	9.4	39.0	9.3	1.1	22	70	150	9.3
Clabber Creek near mouth near Rush	T17	08/23/02	67	69	7.4	41.0	8.1	2.0	5	40	140	39.7
Clabber Creek near Rush	T17-S	08/09/01	54	60	12.5	23.5	6.1	0.9	35	70	150	24.7
Clabber Creek near Rush	T17-S	08/28/02	54	77	10.3	33.8	8.3	2.3	5	43	120	19.3

**Table 2.** Stream-habitat information.—Continued

[Values for canopy angle, canopy cover, depth, velocity index, and width are length-weighted means based on riffle, glide, and pool lengths and mean values for riffles, glides, and pools. km<sup>2</sup>, square kilometers; cm, centimeters; mm, millimeters; m, meters; D16, D50, and D84, 16th, 50th, and 84th percentiles of substrate particle sizes from Wolman pebble counts]

Site name	Site identifier	Date	Drainage area (km <sup>2</sup> )	Canopy angle (degrees)	Canopy cover (number of grid inter-sections covered)	Depth (cm)	Wetted width (m)	Velocity index (mm)	D16 (mm)	D50 (mm)	D84 (mm)	Bedrock (percent)
Big Creek near mouth near Cozahome	T18	07/10/01	346	73	6.8	41.5	12.4	2.4	20	45	120	19.3
Big Creek near mouth near Cozahome	T18	07/10/02	346	72	8.6	44.4	25.9	3.7	10	30	60	23.3
Middle Creek near mouth near Big Flat	T23	07/11/01	29	29	8.8	18.2	6.3	0.3	25	63	222	40.0
Middle Creek near mouth near Big Flat	T23	07/11/02	29	52	11.5	8.6	7.4	1.1	13	50	223	17.0
Leatherwood Creek near mouth near Advance	T24	07/11/01	32	49	9.8	43.6	9.2	0.8	15	45	130	2.7
Leatherwood Creek near mouth near Advance	T24	07/11/02	32	63	9.8	43.6	10.1	0.9	5	30	120	9.7
Hock Creek near Wesley	OB1	08/15/01	41	60	10.8	12.1	3.0	0.2	10	40	100	17.0
Hock Creek near Wesley	OB1	06/26/02	41	62	8.8	19.9	5.7	11.4	10	30	80	4.0
Kings River near Kingston	OB2	08/14/01	162	74	8.0	16.9	9.9	0.9	25	54	90	11.7
Kings River near Kingston	OB2	06/26/02	162	66	10.8	26.5	16.4	5.8	20	60	120	11.0
Osage Creek near Berryville	OB3	08/13/01	380	109	5.3	24.1	14.0	4.5	21	58	127	33.3
Osage Creek near Berryville	OB3	08/20/02	380	105	5.5	30.3	15.6	9.6	20	50	83	69.0
Yocum Creek near Oak Grove	OB4	08/15/01	134	55	10.5	29.7	9.2	5.1	NA	NA	NA	NA
Yocum Creek near Oak Grove	OB4	08/05/02	134	57	11.2	23.5	10.5	20.4	20	60	110	4.3
Long Creek near Denver	OB5	08/17/01	266	83	6.6	45.2	12.5	1.9	10	25	50	0.0
Long Creek near Denver	OB5	09/10/02	266	94	10.4	74.2	17.4	3.4	1	30	62	0.0
Huzzah Creek near Olvey	OB6	08/16/01	63	88	8.9	32.7	8.8	1.8	1	20	60	29.7
Huzzah Creek near Olvey	OB6	08/26/02	63	73	9.8	33.2	9.2	1.7	1	15	65	25.3
Clear Creek near Pyatt	OB7	08/16/01	282	46	10.7	45.8	12.3	3.2	1	35	80	25.0
Clear Creek near Pyatt	OB7	09/17/02	282	66	10.1	43.3	13.1	6.9	1	40	70	8.0
Hampton Creek near Eros	OB8	08/22/01	57	73	6.0	39.4	6.3	4.5	12	35	80	3.3
Hampton Creek near Eros	OB8	08/22/02	57	75	8.3	19.7	7.4	5.0	5	40	80	0.0
Crooked Creek near Summit	OB9	07/23/01	1,037	99	6.7	42.6	18.4	16.9	25	70	212	0.0
Crooked Creek near Summit	OB9	09/18/02	1,037	121	3.3	46.8	15.8	20.0	1	50	280	0.0
North Sylamore Creek near Big Flat	OB10	08/20/01	84	62	7.6	23.5	9.3	3.0	10	30	80	43.0
North Sylamore Creek near Big Flat	OB10	07/17/02	84	35	NA	27.2	9.9	5.7	NA	NA	NA	NA

**Table 3. Water-quality information.**

[Values are means for samples collected between April 2001 and October 2002. Samples collected by National Park Service and analyzed by Arkansas Department of Environmental Quality. Some sites sampled by Arkansas Department of Environmental Quality or U.S. Geological Survey. Temperature, specific conductance, pH, dissolved oxygen, and turbidity measured in field. C: Celsius; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; NTU, nephelometric turbidity units; cols./100 mL, colonies per 100 milliliters; N, nitrogen; P, phosphorus]

Site name	Site identifier	Number of samples	Temperature (degrees C)	Specific conductance (µS/cm)	pH (units)	Dissolved oxygen (mg/L)	Turbidity (NTU)	Fecal coliform bacteria (cols./100mL)	Ammonia (mg/L as N)	Nitrite plus nitrate (mg/L as N)	Ortho-phosphorus (mg/L as P)
Buffalo River at Dixon Ford near Fallsville	R0	5	16.6	23	7.0	8.9	7.7	39	0.007	0.056	0.005
Buffalo River near Boxley	R1	5	14.8	86	7.5	9.6	4.2	42	<0.005	0.044	<0.005
Buffalo River near Ponca	R2	5	15.4	121	7.5	9.6	4.6	54	0.005	0.086	<0.005
Buffalo River near Pruitt	R3	5	16.9	144	7.8	9.5	4.9	49	0.007	0.059	<0.005
Buffalo River near Hasty	R4	5	17.7	164	8.0	9.0	4.7	72	0.011	0.107	0.005
Buffalo River near Woolum	R5	5	18.9	179	8.1	9.6	3.9	14	0.008	0.121	0.005
Buffalo River at Shine Eye near Gilbert	R6	5	19.0	179	8.1	9.4	4.7	85	0.005	0.152	0.006
Buffalo River at Highway 14 near Harriet	R7	4	23.0	200	8.2	10.1	2.4	29	<0.005	0.101	<0.005
Buffalo River near Rush	R8	5	20.8	210	8.2	9.5	2.5	73	<0.005	0.108	0.005
Buffalo River near mouth near Buffalo City	R9	4	20.4	199	8.2	9.8	4.4	135	0.007	0.053	0.030
Beech Creek near mouth near Boxley	T1	4	12.9	74	7.9	10.2	4.4	40	<0.005	0.037	0.005
Ponca Creek near mouth near Ponca	T2	6	14.9	255	8.0	9.3	2.5	92	0.008	0.139	0.005
Cecil Creek near mouth near Erbie	T3	6	15.5	223	7.9	9.4	3.0	69	<0.005	0.051	<0.005
Mill Creek near mouth near Pruitt	T4	6	16.0	312	8.0	10.0	2.9	48	0.009	0.631	0.007
Little Buffalo River near mouth near Pruitt	T5	6	16.8	178	7.9	9.4	4.4	20	<0.005	0.123	0.006
East Fork Little Buffalo River near Murray	T5-HW	5	17.5	119	7.9	9.6	3.7	31	0.005	0.065	0.007
Big Creek near mouth near Carver	T6	6	21.0	220	7.8	8.3	7.8	137	0.011	0.199	0.013
Big Creek near Vendor	T6-S	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Left Fork Big Creek near Red Rock	T6-HW1	5	18.6	70	7.2	9.1	2.7	17	0.007	0.067	0.008
Big Creek near Mt. Judea	T6-HW2	5	18.2	152	7.5	8.6	2.3	22	0.005	0.171	0.008
Davis Creek near mouth near Mt. Hersey	T7	6	15.7	400	7.8	9.5	3.2	276	<0.005	0.518	0.014
Cave Creek near mouth near Mt. Hersey	T8	6	16.5	211	7.9	8.7	1.5	13	0.010	0.174	0.014
Cave Creek near Woolum	T8-S	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cave Creek near Bass	T8-HW	5	17.3	130	7.4	9.4	2.6	18	0.004	0.078	0.005
Richland Creek near mouth near Eula	T9	5	16.5	116	8.0	9.8	2.1	19	<0.005	0.065	<0.005
Richland Creek near Ben Hur	T9-HW1	5	18.6	46	7.2	9.2	3.0	12	<0.005	0.060	<0.005
Richland Creek near Witts Springs	T9-HW2	5	17.2	115	7.6	9.9	2.1	50	0.006	0.039	<0.005
Falling Water Creek near Witts Springs	T9-HW3	5	18.5	54	7.1	9.0	4.4	11	<0.005	0.036	<0.005
Calf Creek near mouth near Silver Hill	T10	6	15.5	271	7.8	9.0	14.9	868	0.029	0.430	0.054
Mill Creek near mouth near Silver Hill	T11	6	15.7	300	8.0	9.3	5.2	148	0.032	0.369	0.026
Bear Creek near mouth near Gilbert	T12	6	18.9	216	8.2	10.4	16.8	232	0.031	0.341	0.037

**Table 3. Water-quality information.—Continued**

[Values are means for samples collected between April 2001 and October 2002. Samples collected by National Park Service and analyzed by Arkansas Department of Environmental Quality. Some sites sampled by Arkansas Department of Environmental Quality or U.S. Geological Survey. Temperature, specific conductance, pH, dissolved oxygen, and turbidity measured in field. C: Celsius;  $\mu\text{S}/\text{cm}$ , microsiemens per centimeter at 25 degrees Celsius;  $\text{mg}/\text{L}$ , milligrams per liter; NTU, nephelometric turbidity units; cols./100 mL, colonies per 100 milliliters; N, nitrogen; P, phosphorus]

Site name	Site identifier	Number of samples	Temperature (degrees C)	Specific conductance ( $\mu\text{S}/\text{cm}$ )	pH (units)	Dissolved oxygen ( $\text{mg}/\text{L}$ )	Turbidity (NTU)	Fecal coliform bacteria (cols./100mL)	Ammonia ( $\text{mg}/\text{L}$ as N)	Nitrite plus nitrate ( $\text{mg}/\text{L}$ as N)	Ortho-phosphorus ( $\text{mg}/\text{L}$ as P)
Bear Creek near Welcome Home	T12-HW	5	15.9	76	7.1	9.4	9.3	101	<0.005	0.078	<0.005
Brush Creek near mouth near Gilbert	T13	5	14.7	299	8.1	11.1	3.1	103	0.012	0.692	0.021
Tomahawk Creek near mouth near Tomahawk	T14	6	17.0	357	8.1	10.7	0.8	54	0.006	0.511	0.006
Water Creek near mouth near Evening Star	T15	5	19.7	283	8.2	9.1	0.9	12	0.004	0.135	<0.005
Water Creek near Maumee	T15-S	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rush Creek near mouth near Rush	T16	6	16.3	340	7.9	9.7	0.6	8	<0.005	0.279	<0.005
Clabber Creek near mouth near Rush	T17	6	17.4	427	8.2	10.7	0.6	8	<0.005	0.193	<0.005
Clabber Creek near Rush	T17-S	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Big Creek near mouth near Cozahoma	T18	5	18.4	260	7.8	8.2	0.8	23	0.016	0.203	0.010
Middle Creek near mouth near Big Flat	T23	5	16.6	407	8.0	8.8	0.4	14	0.008	0.041	<0.005
Leatherwood Creek near mouth near Advance	T24	5	17.8	387	8.0	8.4	1.0	58	0.017	0.040	0.006
Hock Creek near Wesley	OB1	5	18.2	100	7.8	9.6	1.7	32	0.008	0.574	0.011
Kings River near Kingston	OB2	5	18.1	78	7.6	8.6	2.6	81	0.013	0.136	0.006
Osage Creek near Berryville <sup>1</sup>	OB3	5	18.4	244	7.9	9.1	2.6	469	0.011	1.168	0.081
Yocum Creek near Oak Grove <sup>2</sup>	OB4	5	16.9	327	7.9	9.5		216	<0.005	4.080	0.055
Long Creek near Denver <sup>1</sup>	OB5	5	16.4	297	7.5	8.0	2.6	225	0.014	1.449	0.278
Huzzah Creek near Olvey	OB6	5	20.5	350	8.2	9.4	3.9	245	0.016	1.212	0.023
Clear Creek near Pyatt	OB7	5	18.7	342	8.2	9.2	1.8	51	0.015	0.914	0.010
Hampton Creek near Eros	OB8	5	18.9	359	8.3	11.4	0.8	24	0.006	0.961	0.012
Crooked Creek near Summit	OB9	5	20.8	302	8.2	10.4	2.3	17	0.008	0.591	0.009
North Sylamore Creek near Big Flat	OB10	5	15.9	259	7.9	9.7	0.5	13	0.005	0.045	0.005

<sup>1</sup>Samples collected and analyzed by Arkansas Department of Environmental Quality.

<sup>2</sup>Samples collected and analyzed by U.S. Geological Survey.





1879–2004